

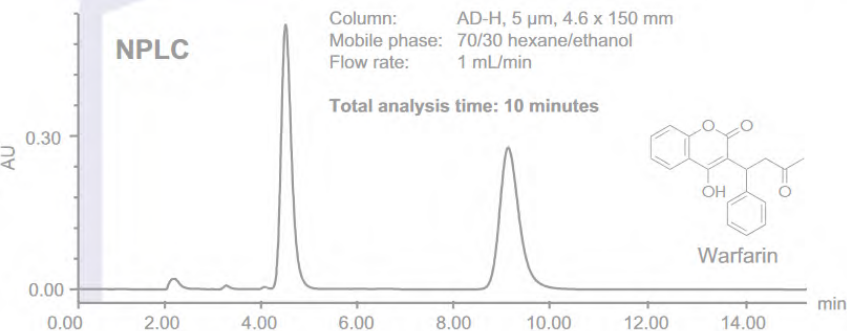
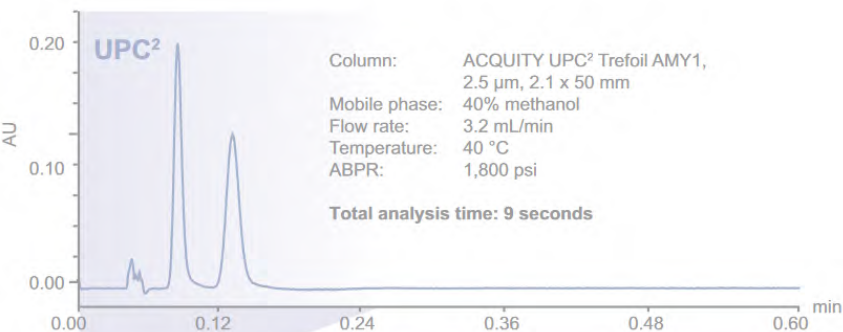
Optimizing the Interface Between Supercritical Fluid Chromatography and Electrospray Ionization Mass Spectrometry

Michael Fogwill

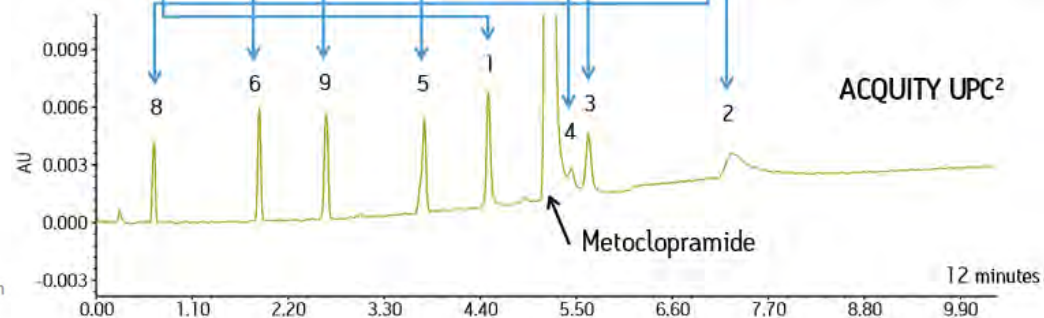
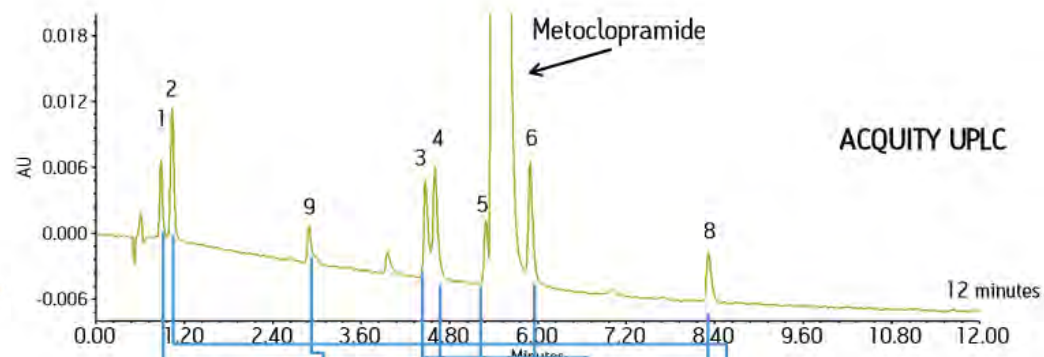
Separations Research, Waters Corporation

GCC 2017 – Jan. 18, 2018

SFC? UPC²?

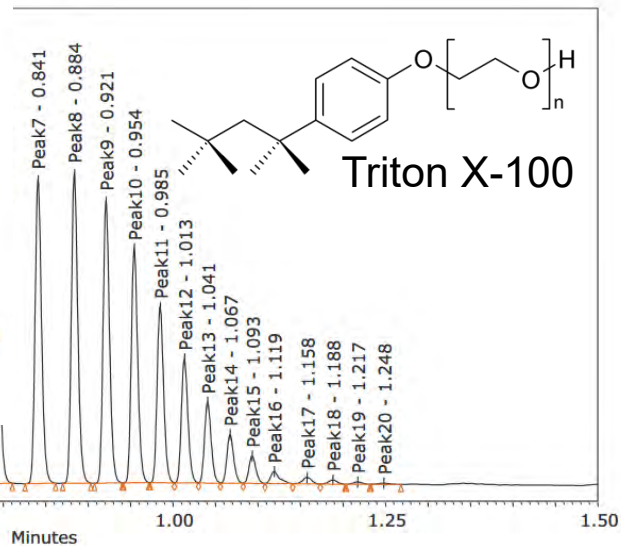
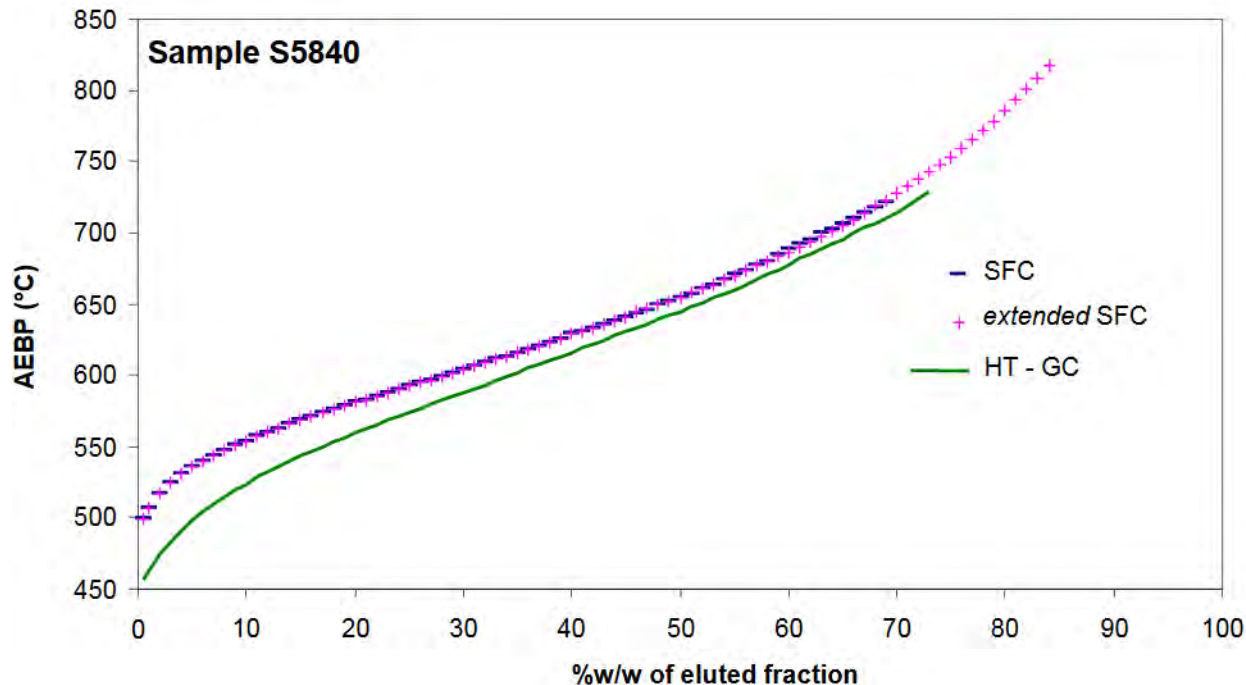


Waters App Note: 720004225en



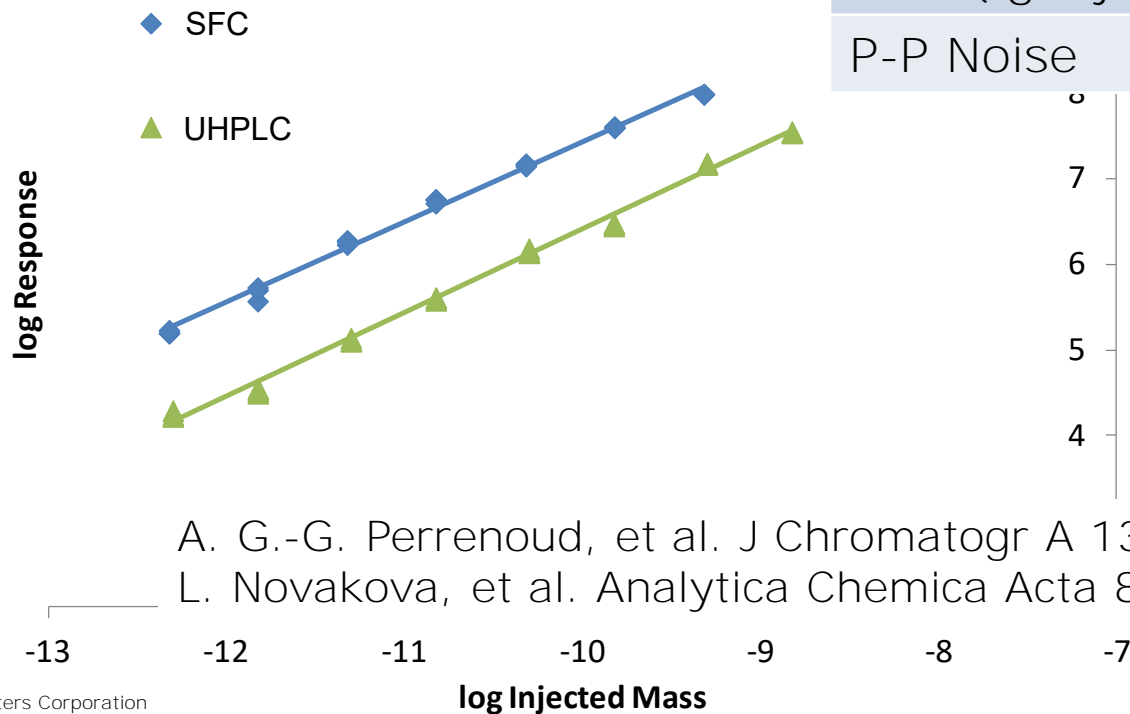
Waters App Note: 720004689en

SFC?

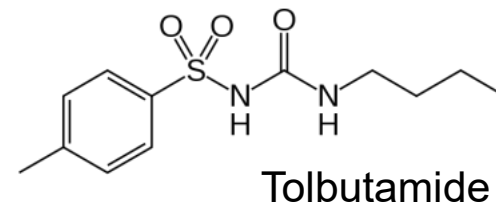


Laure Dahan, Didier Thiebaut,
Fabrice Bertoncini, Didier Espinat
and Alain Quignard

UHPLC-MS vs SFC-MS Sensitivity



	SFC	UHPLC
LOQ (fg injected) [‡]	54.81	380.1
P-P Noise	2402	1096



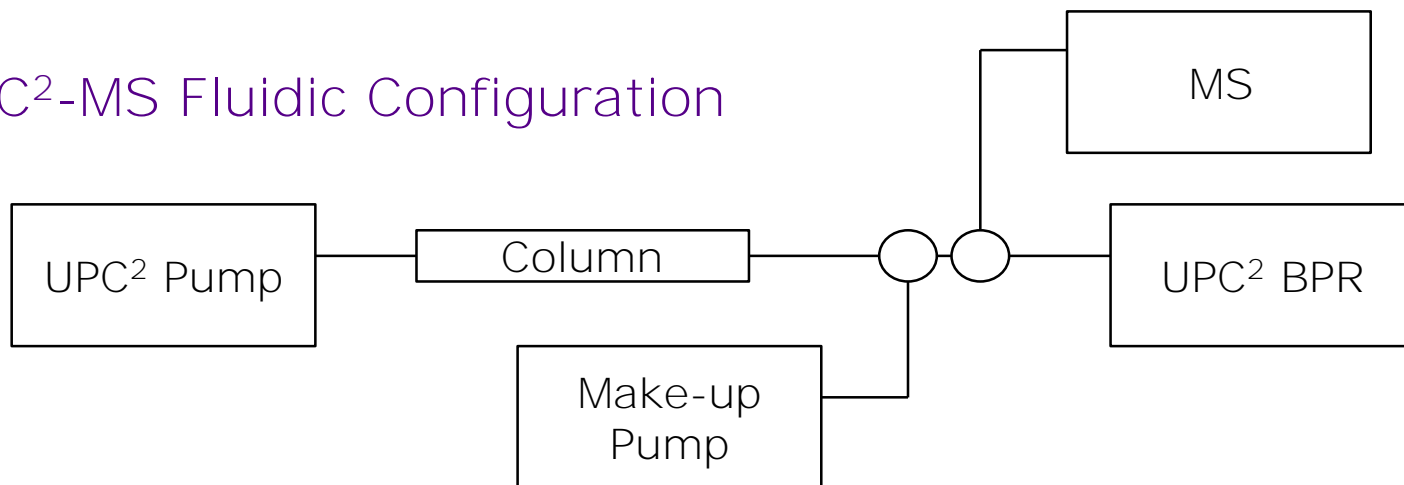
A. G.-G. Perrenoud, et al. J Chromatogr A 1339 (2014) 174-184
L. Novakova, et al. Analytica Chimica Acta 853 (2015) 647-659

Interfacing SFC to MS

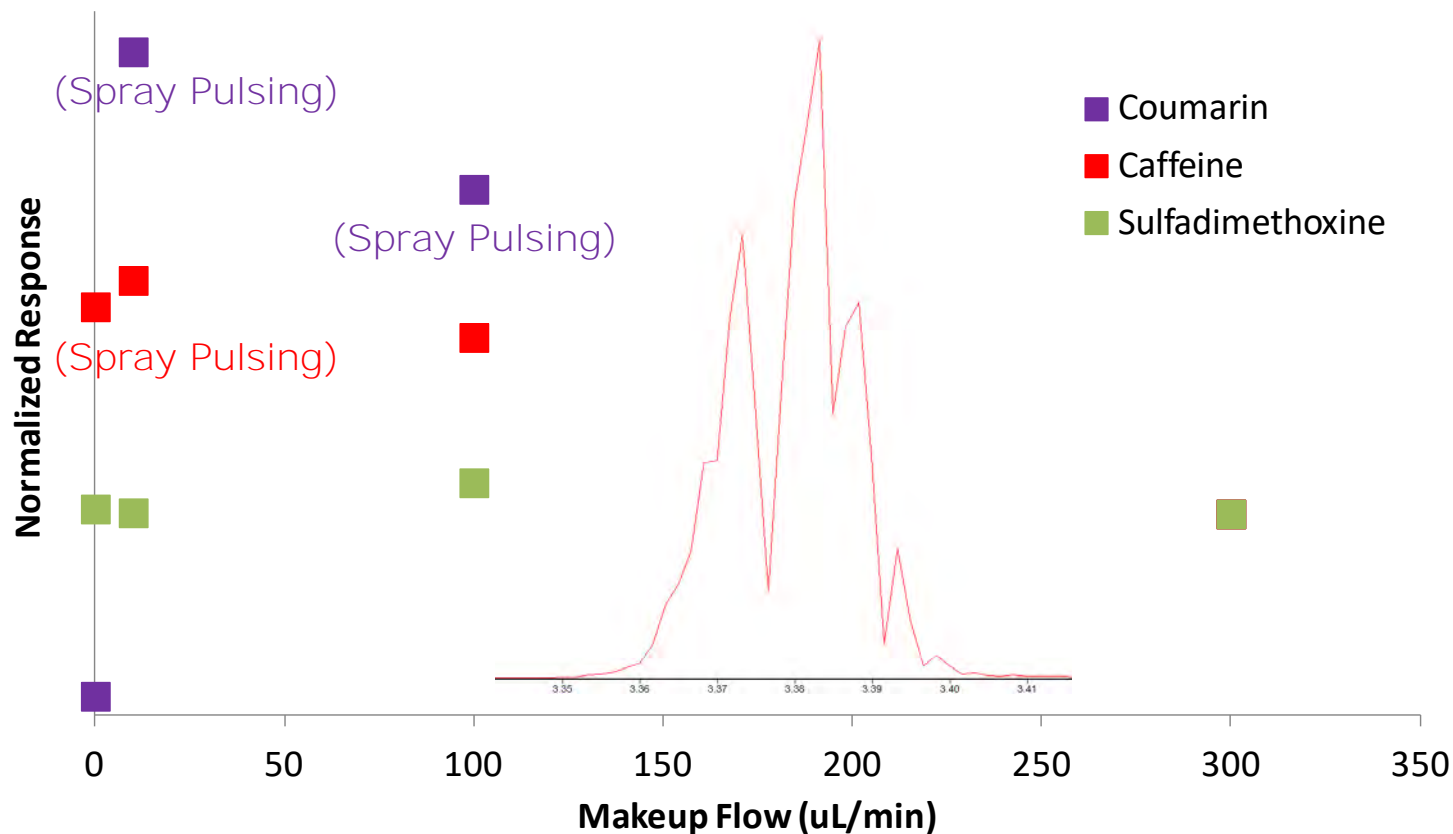
- SFC-MS Optimization:
 - Hardware interface
 - Makeup fluid
 - SFC-MS vs LC-MS sensitivity

~ 300-500 $\mu\text{L}/\text{min}$
(varies with conditions)

UPC²-MS Fluidic Configuration



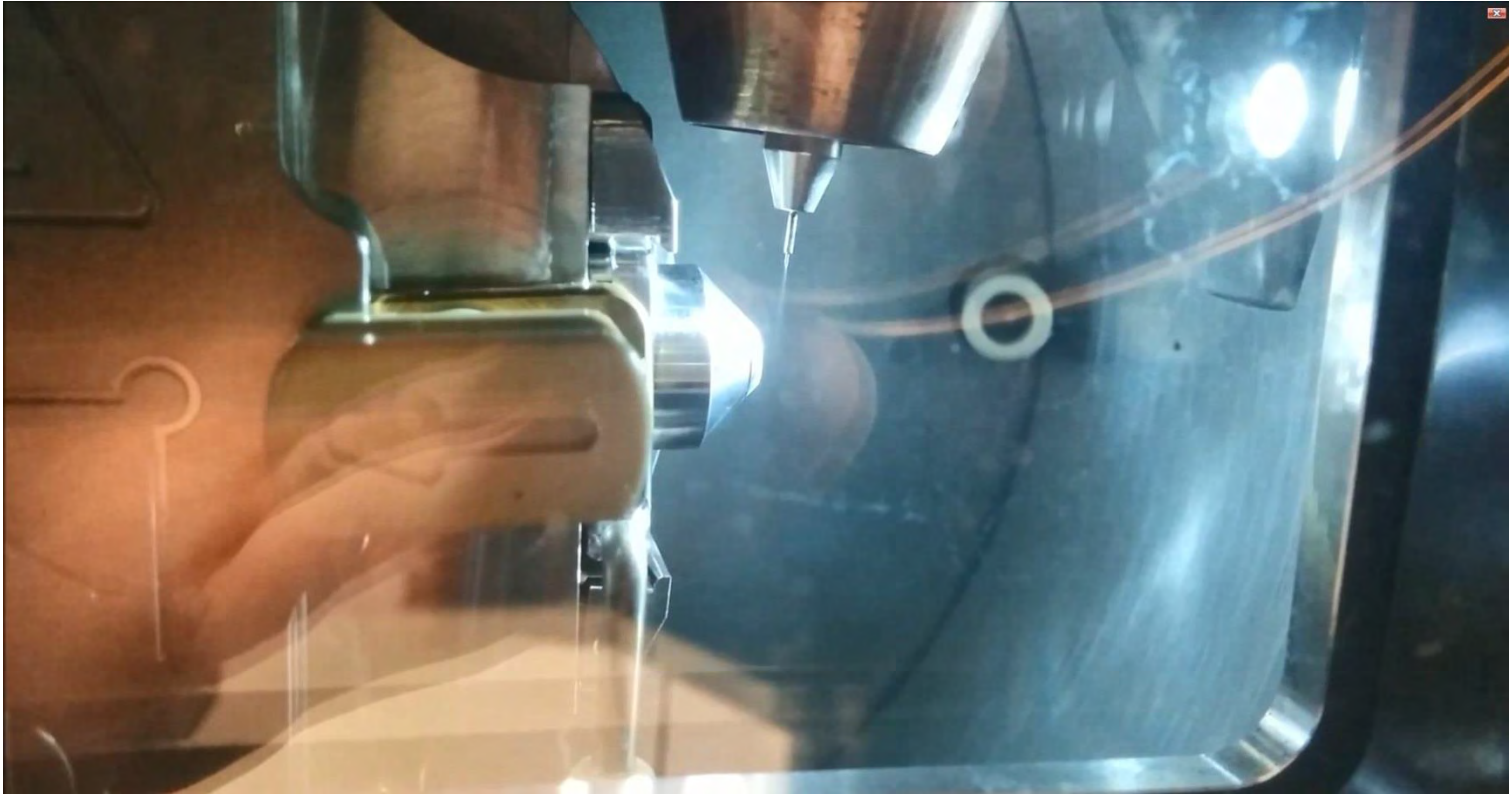
Problem...



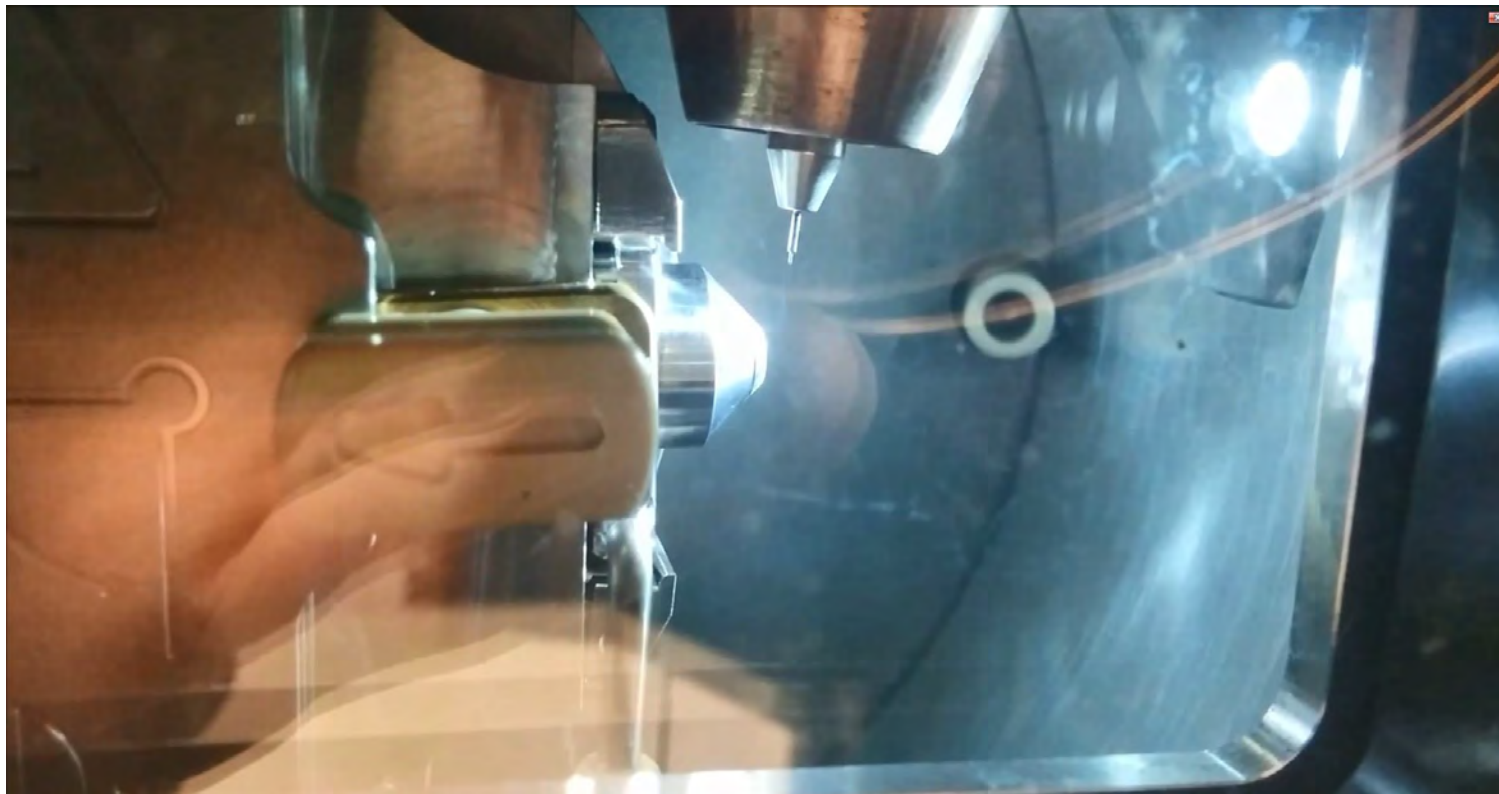
Spray Pulsing



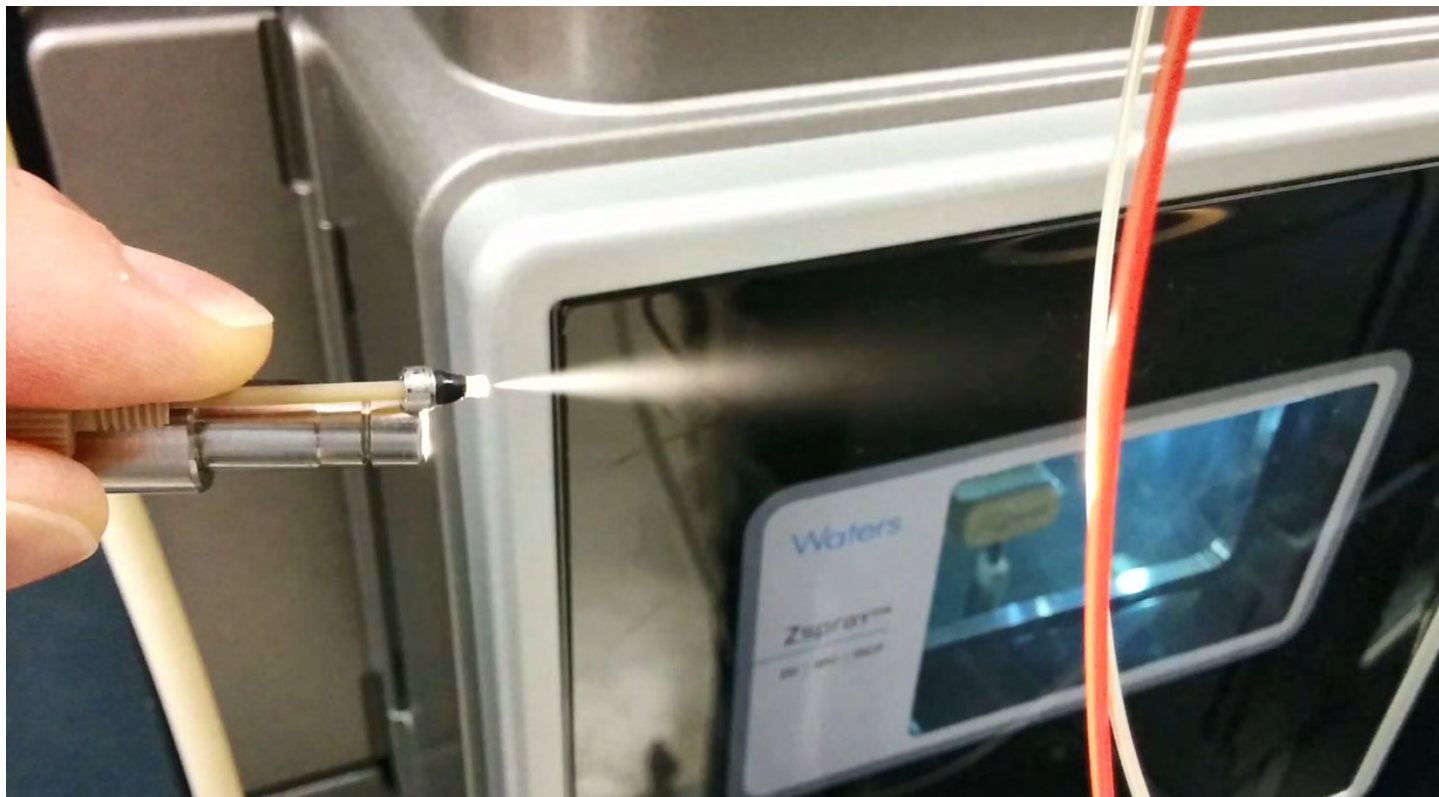
Spray Pulsing



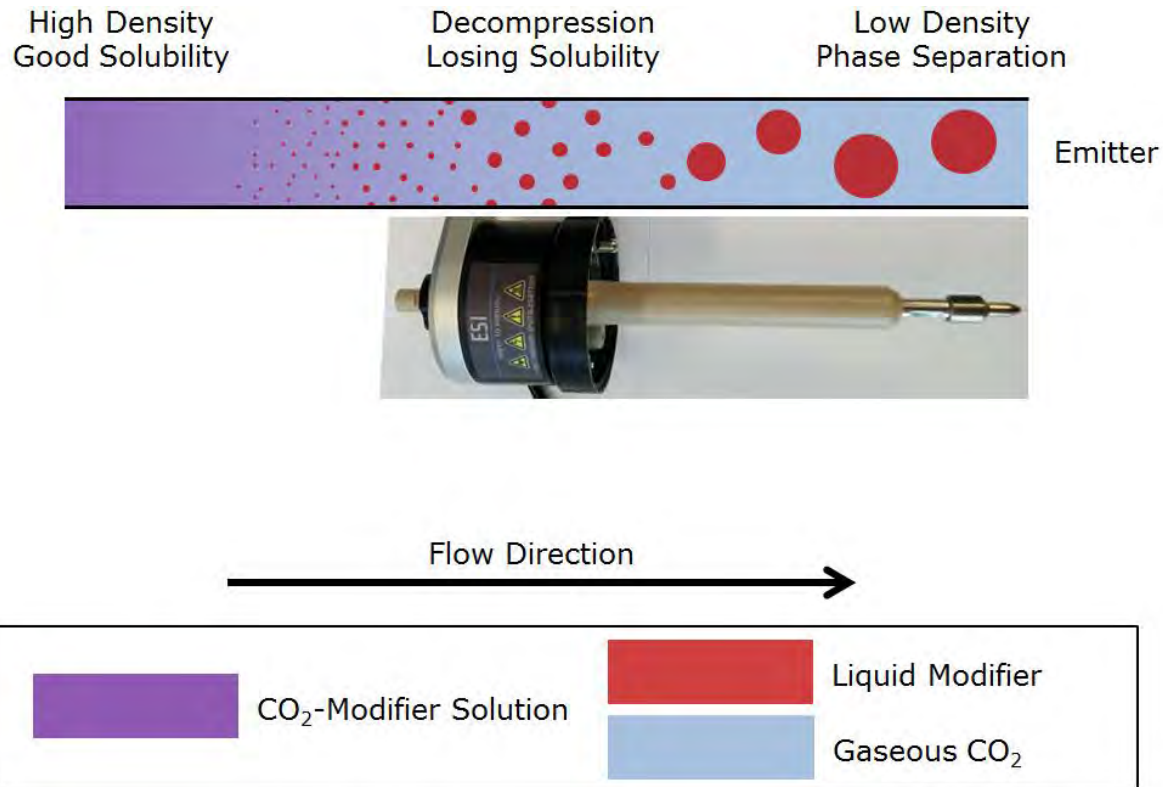
Spray Pulsing



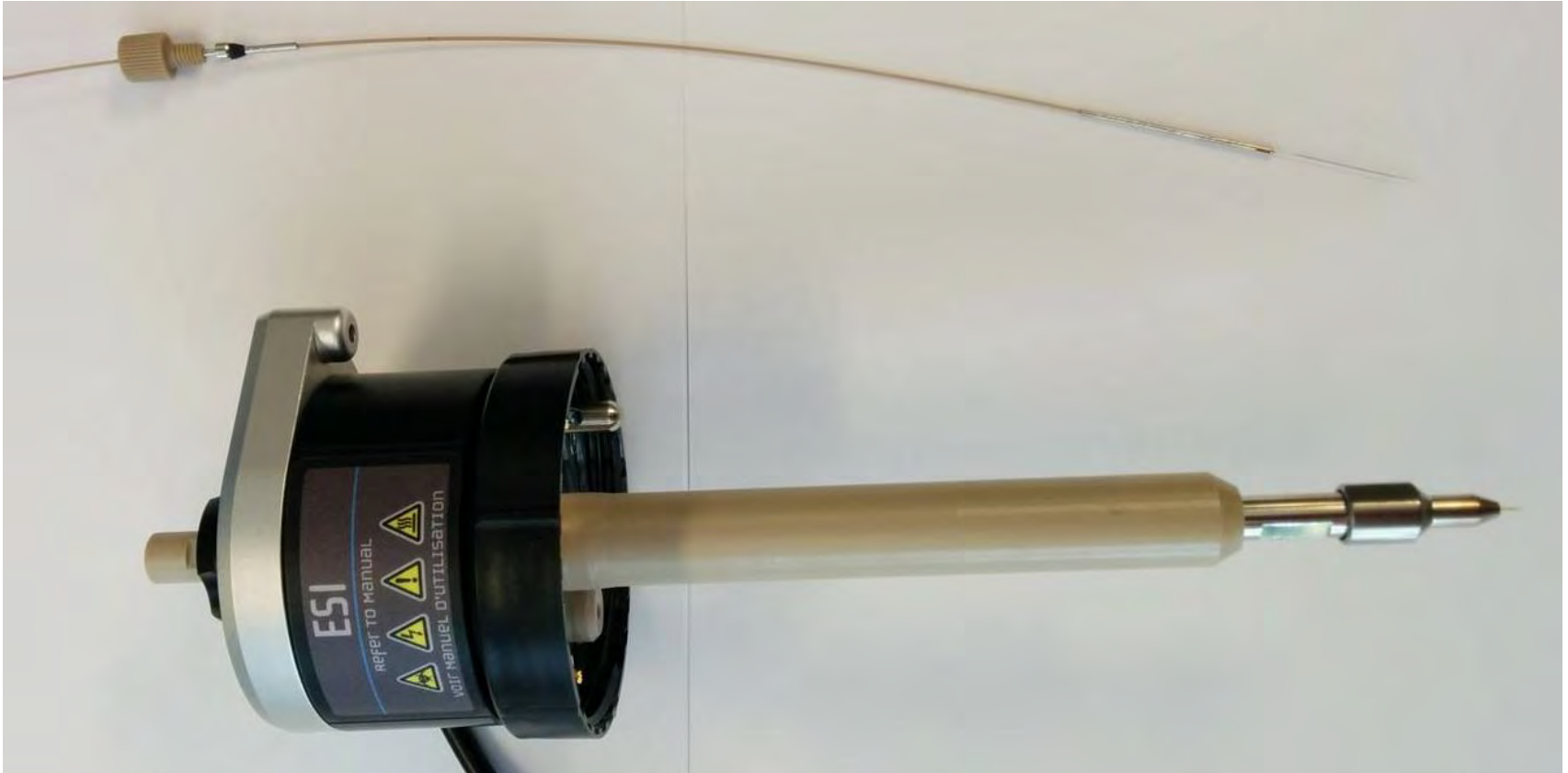
Split-Flow Restrictor Outlet



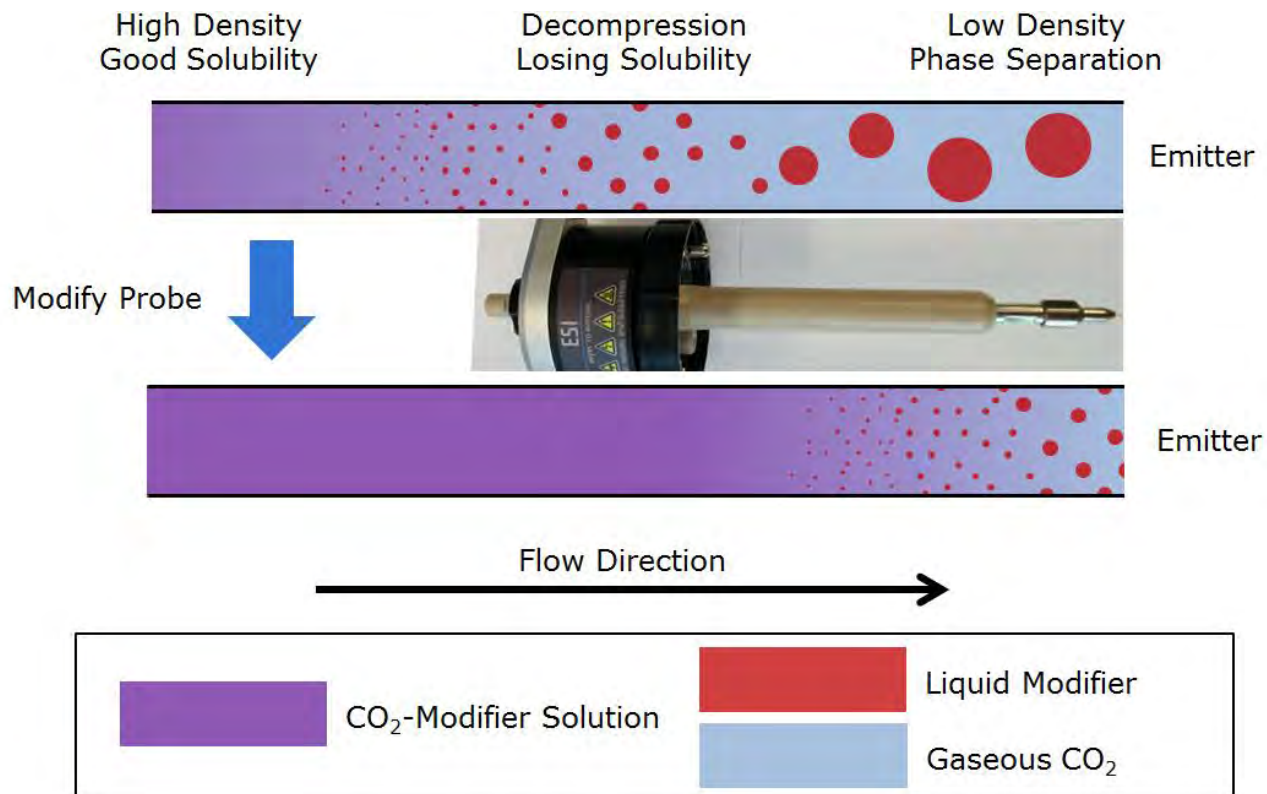
Problem



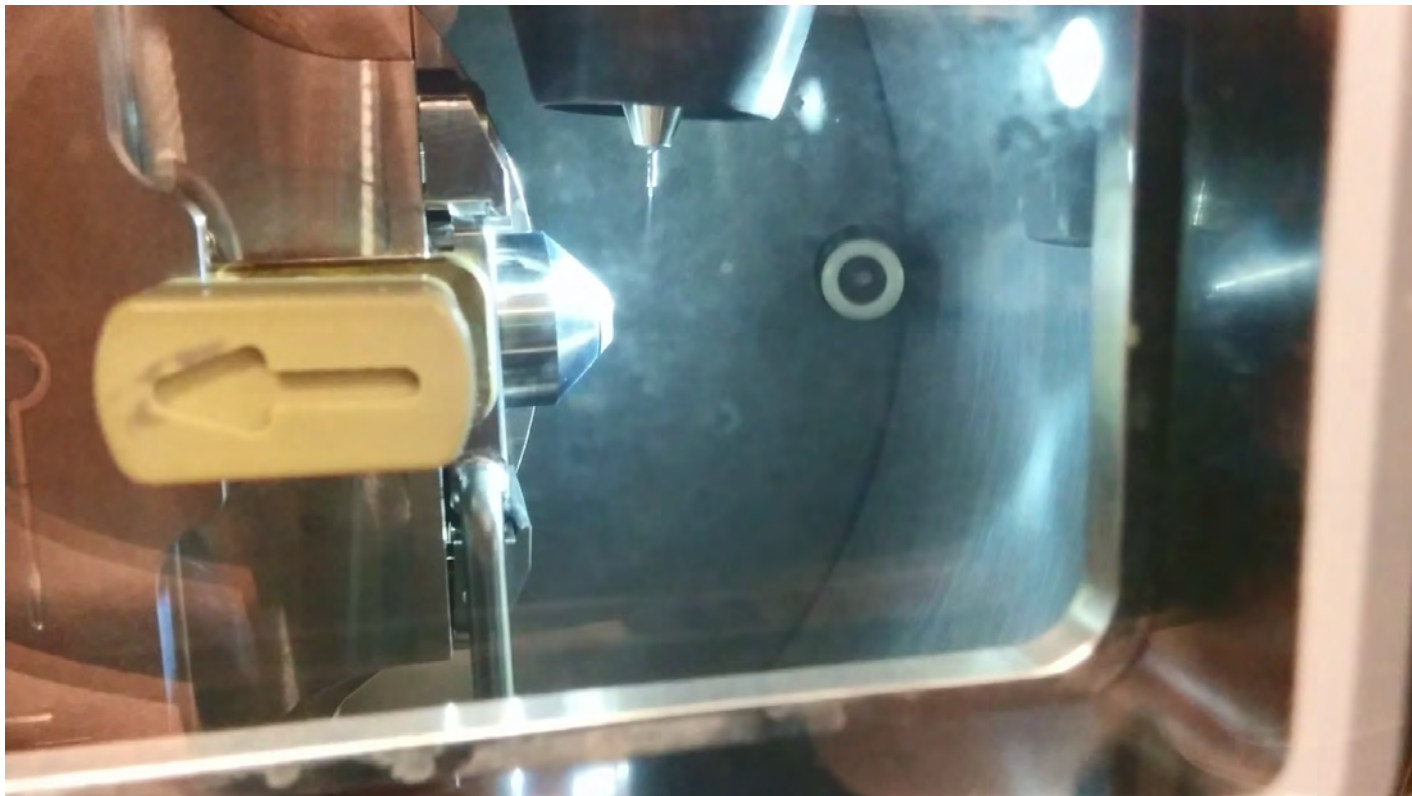
Probe Modification



Remedy: Probe Modification

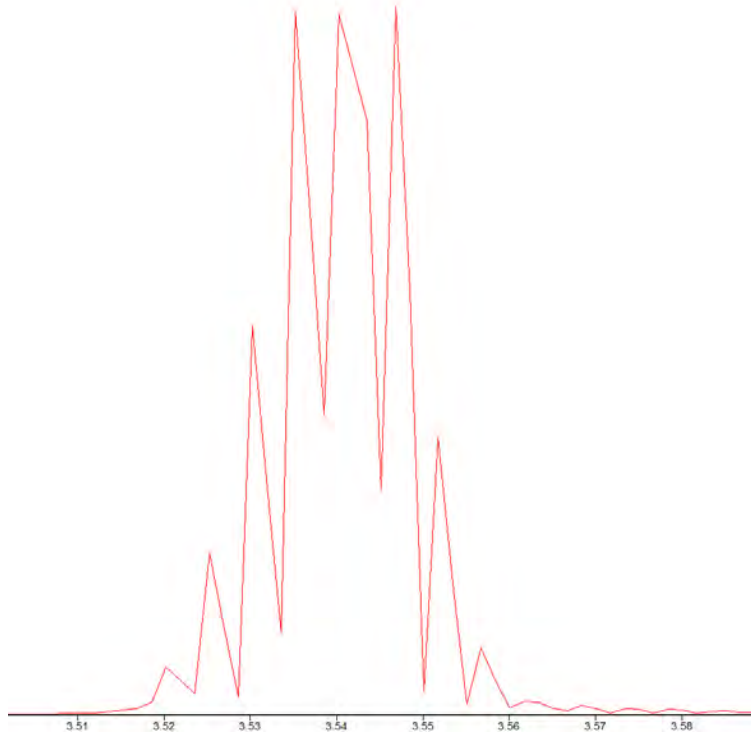


Modified Probe Spray

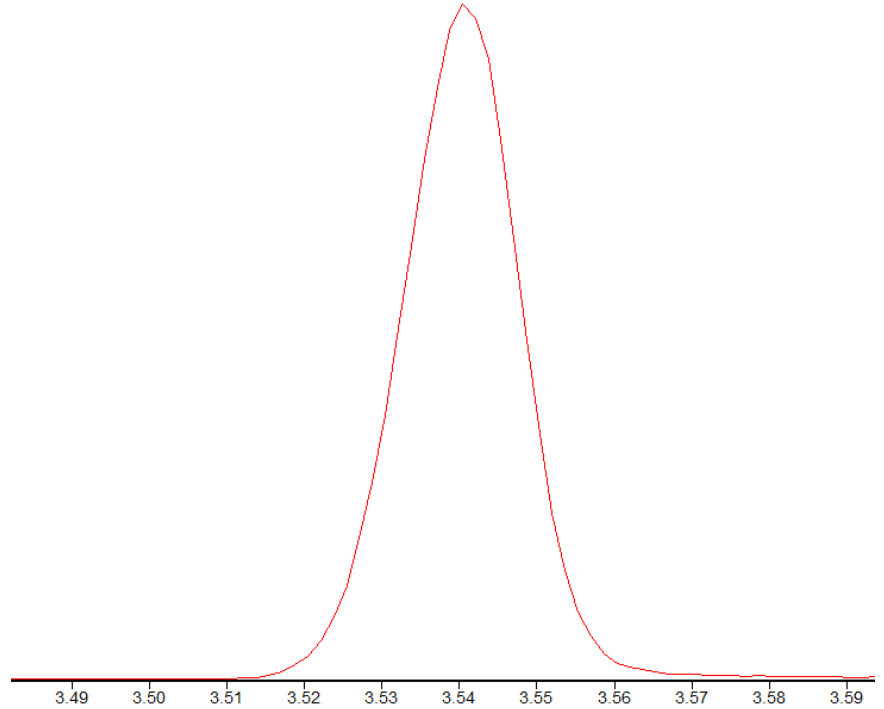


Modified Probe

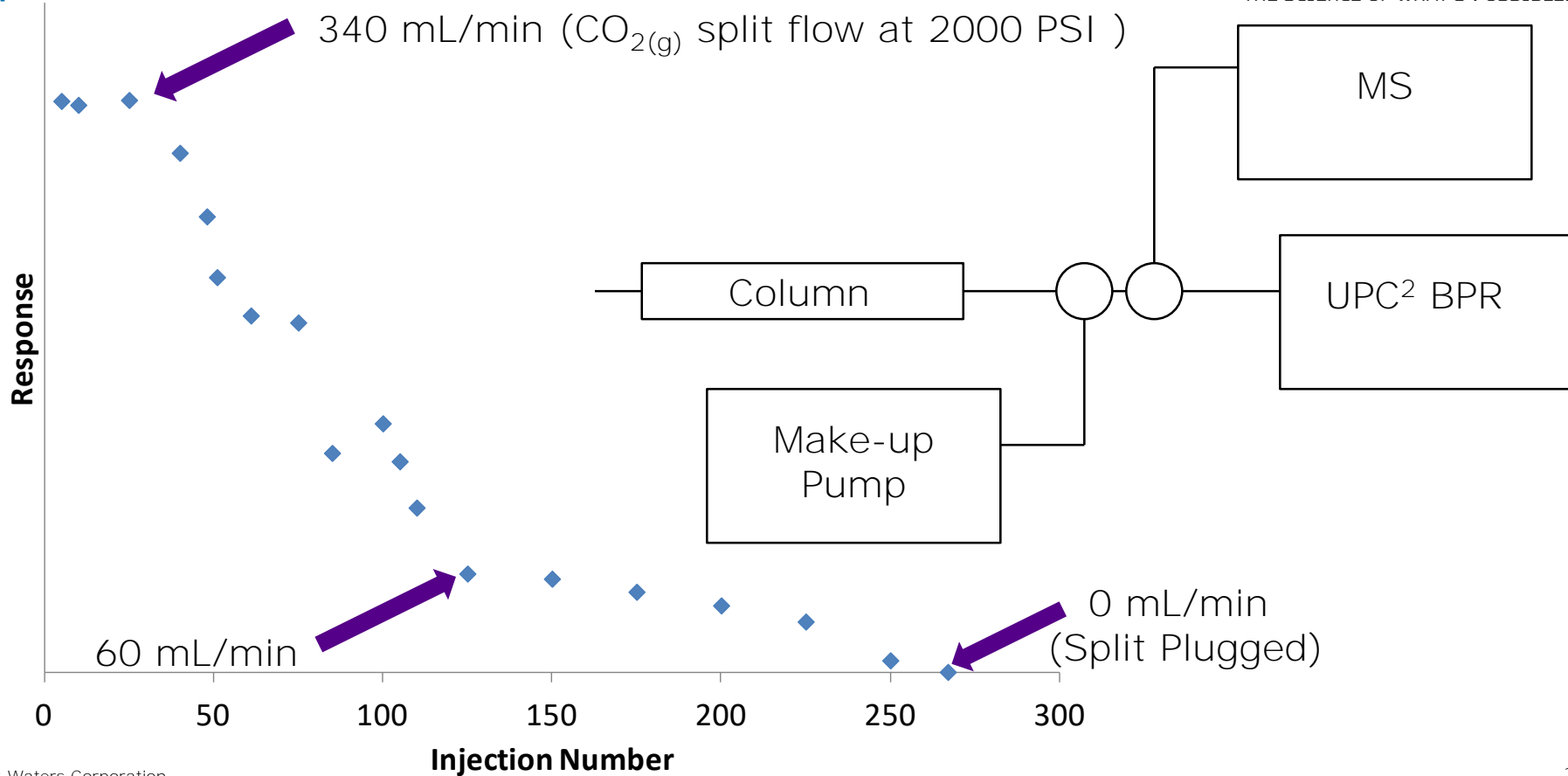
Existing Probe



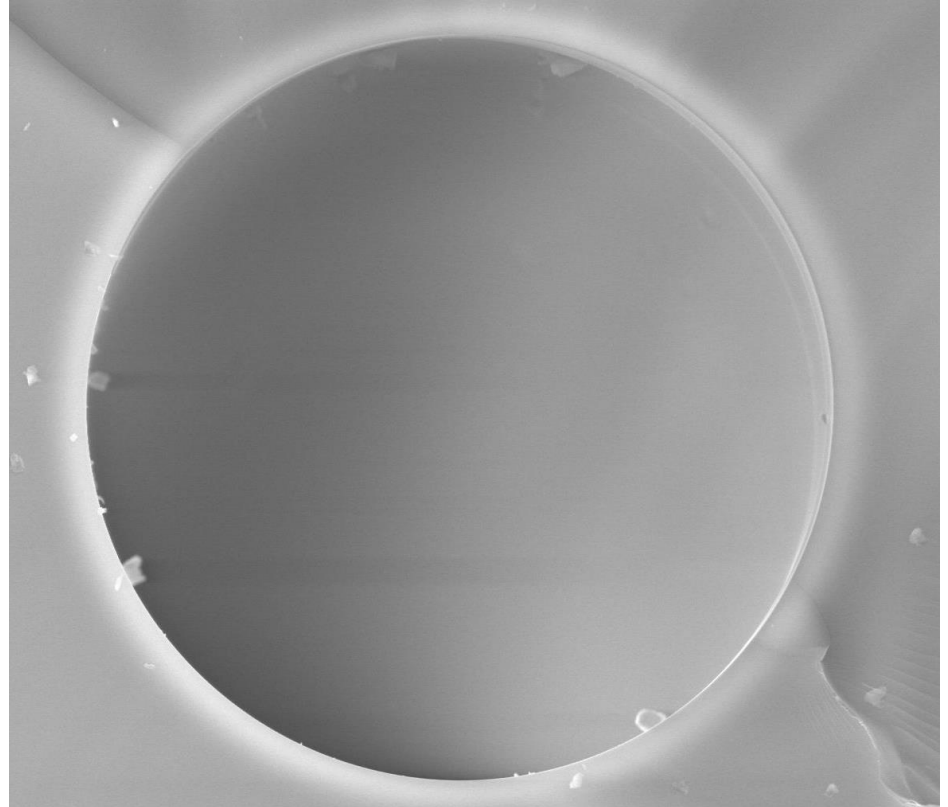
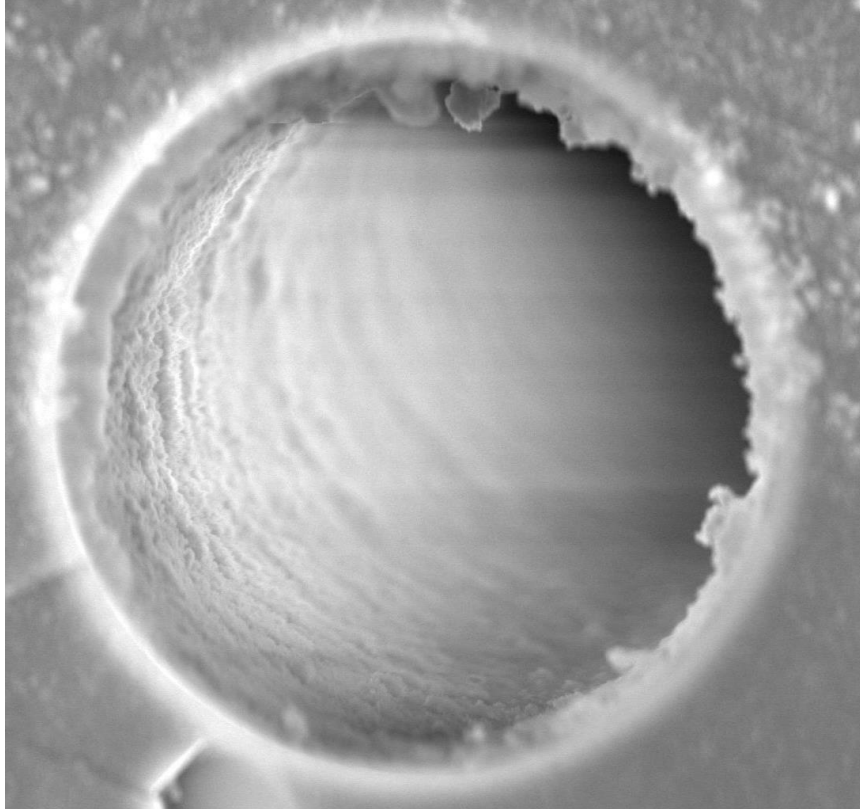
Modified Probe



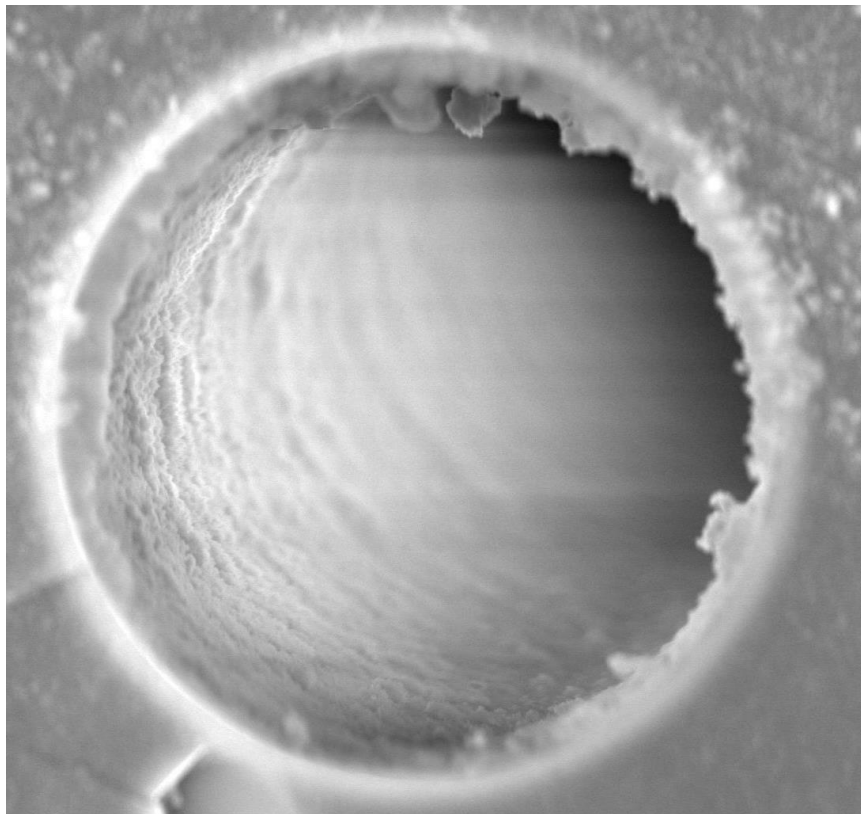
Split Restrictor Robustness



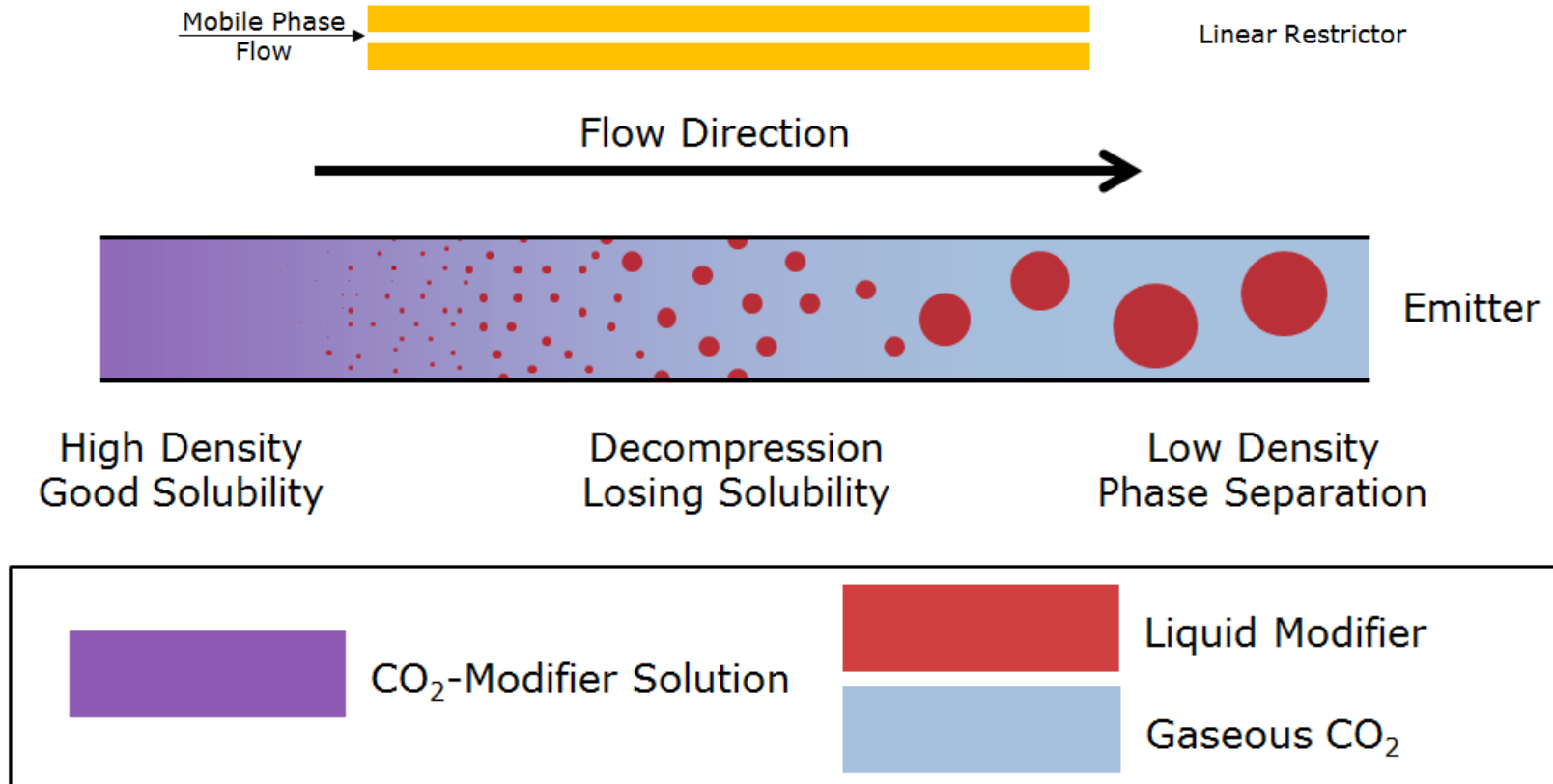
Restrictor Failure Mechanism



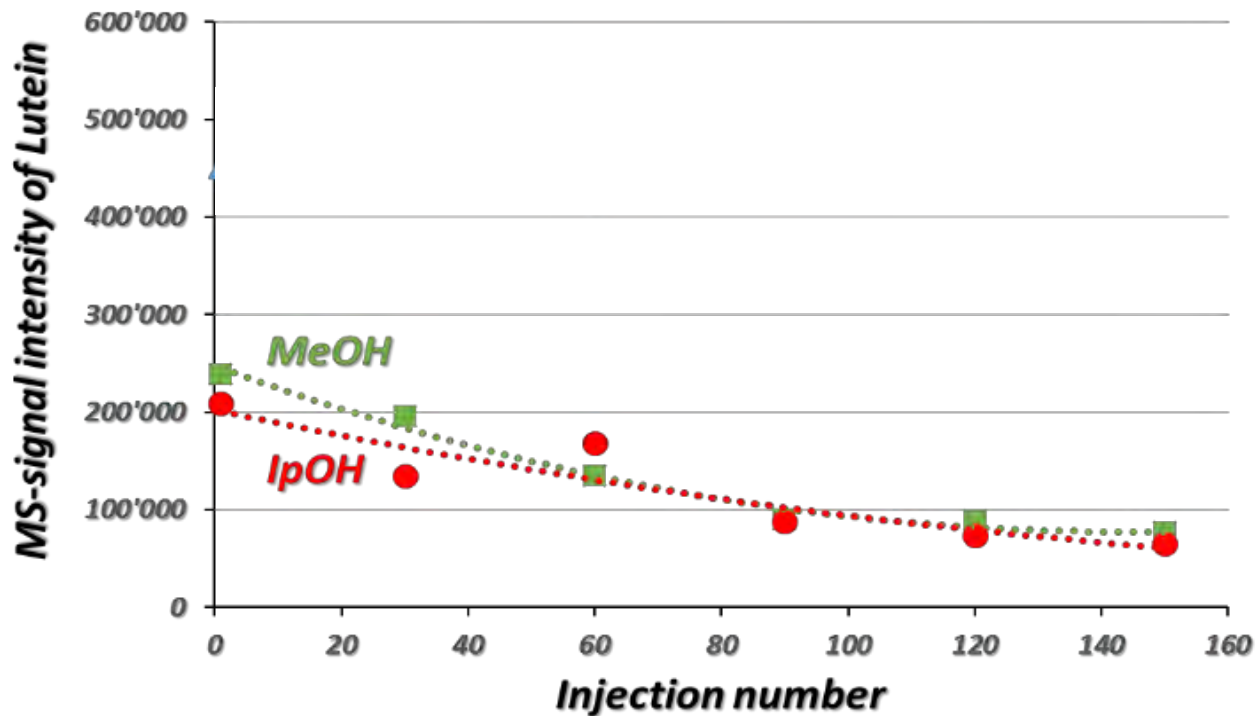
Restrictor Failure Mechanism



Restrictor Failure Mechanism



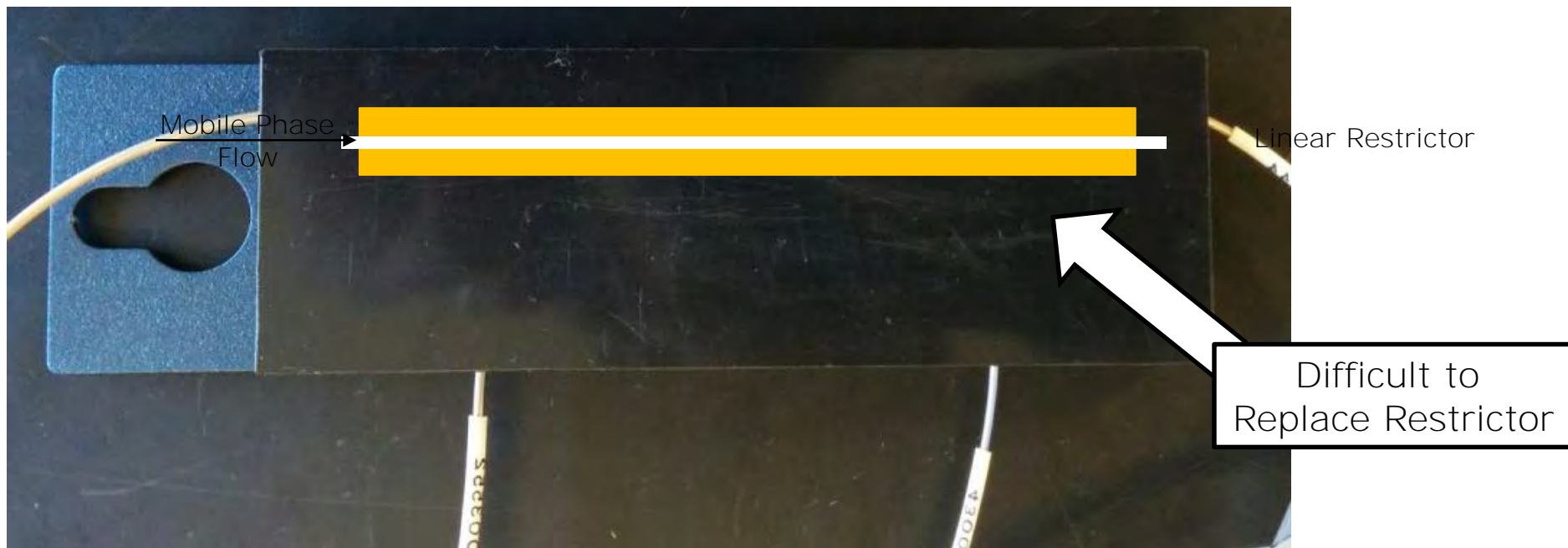
The Fix – Appropriate Makeup Fluid!



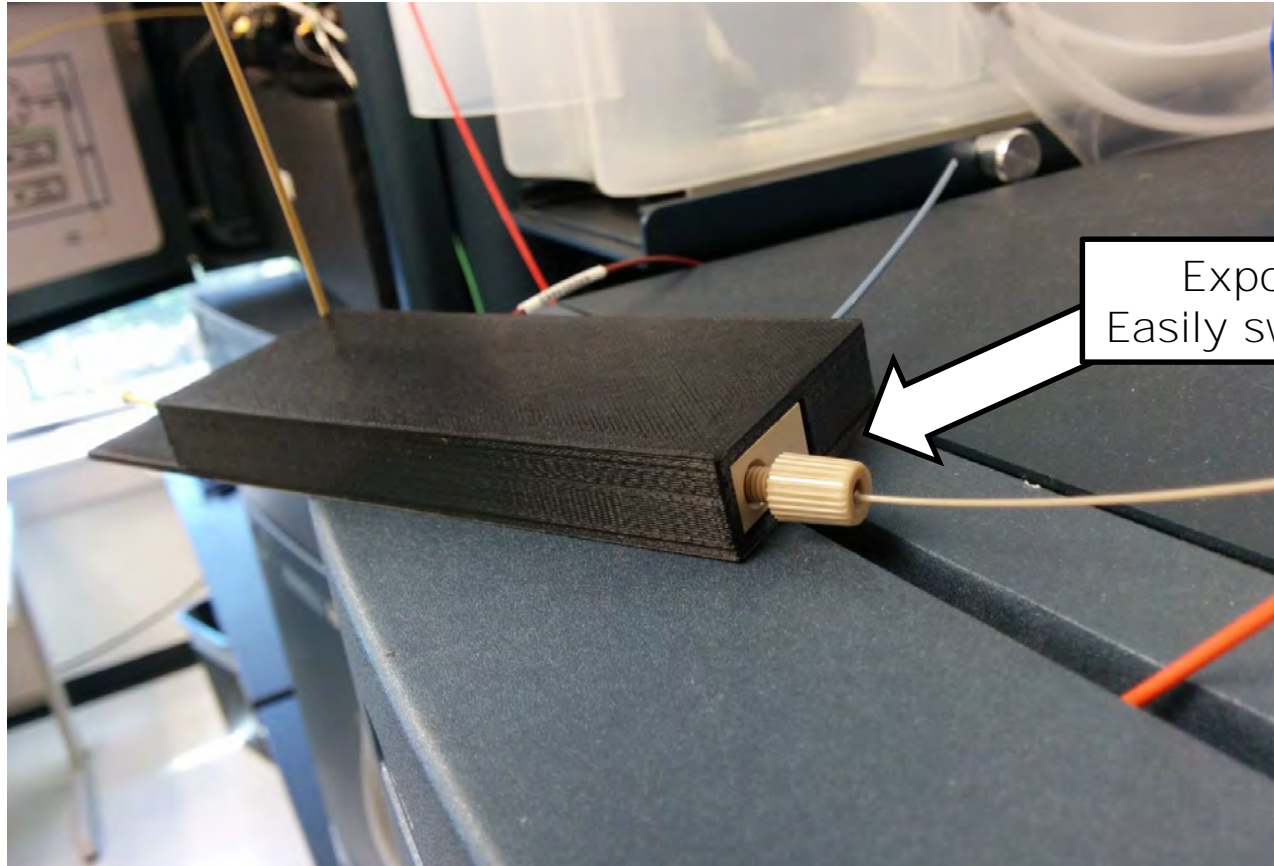
Waters and Nestle Institute of Health Sciences

Restrictor Replacement

- Restrictor failure can still happen



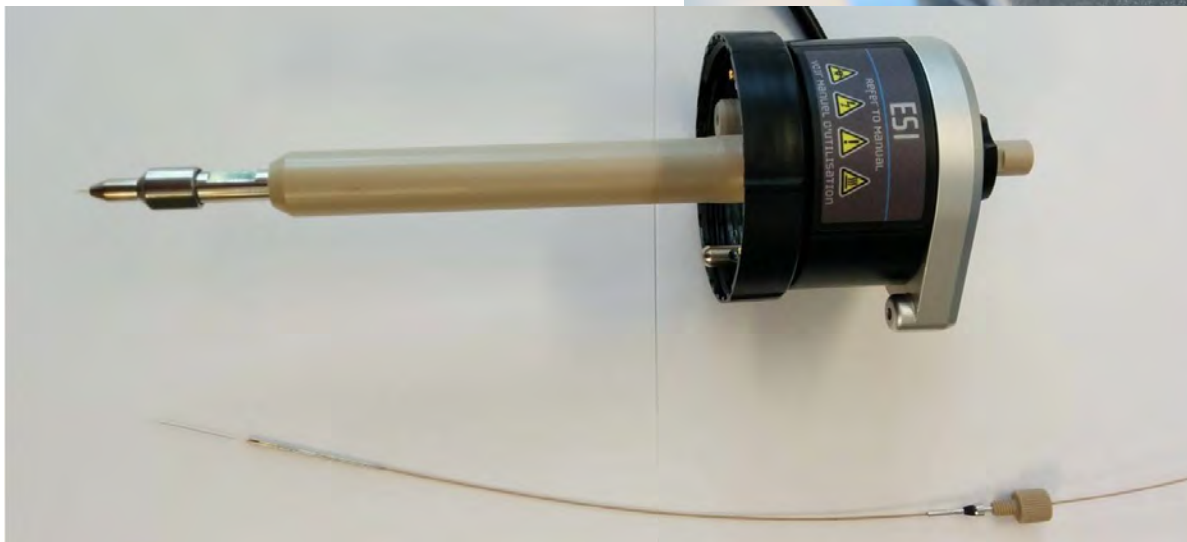
Research Prototype Splitter Housing



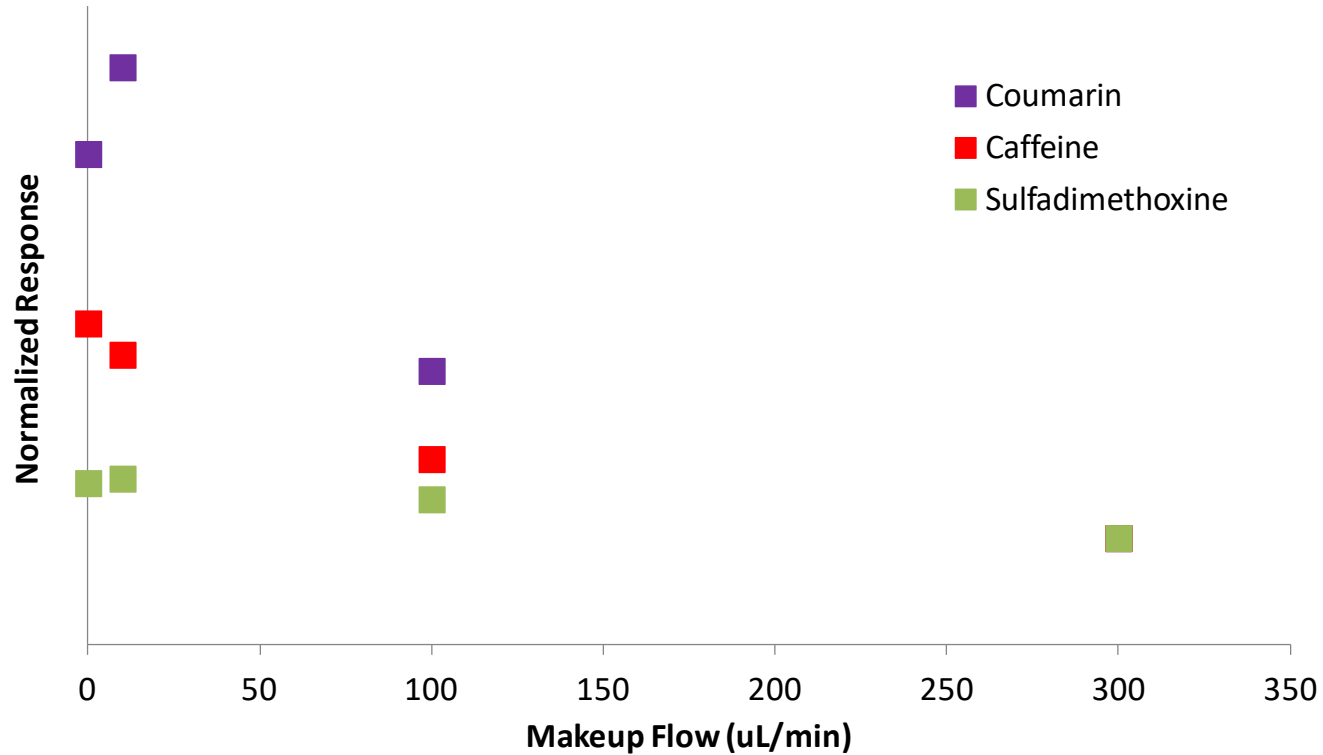
Exposed fitting =
Easily swapped restrictor

Probe Capillary

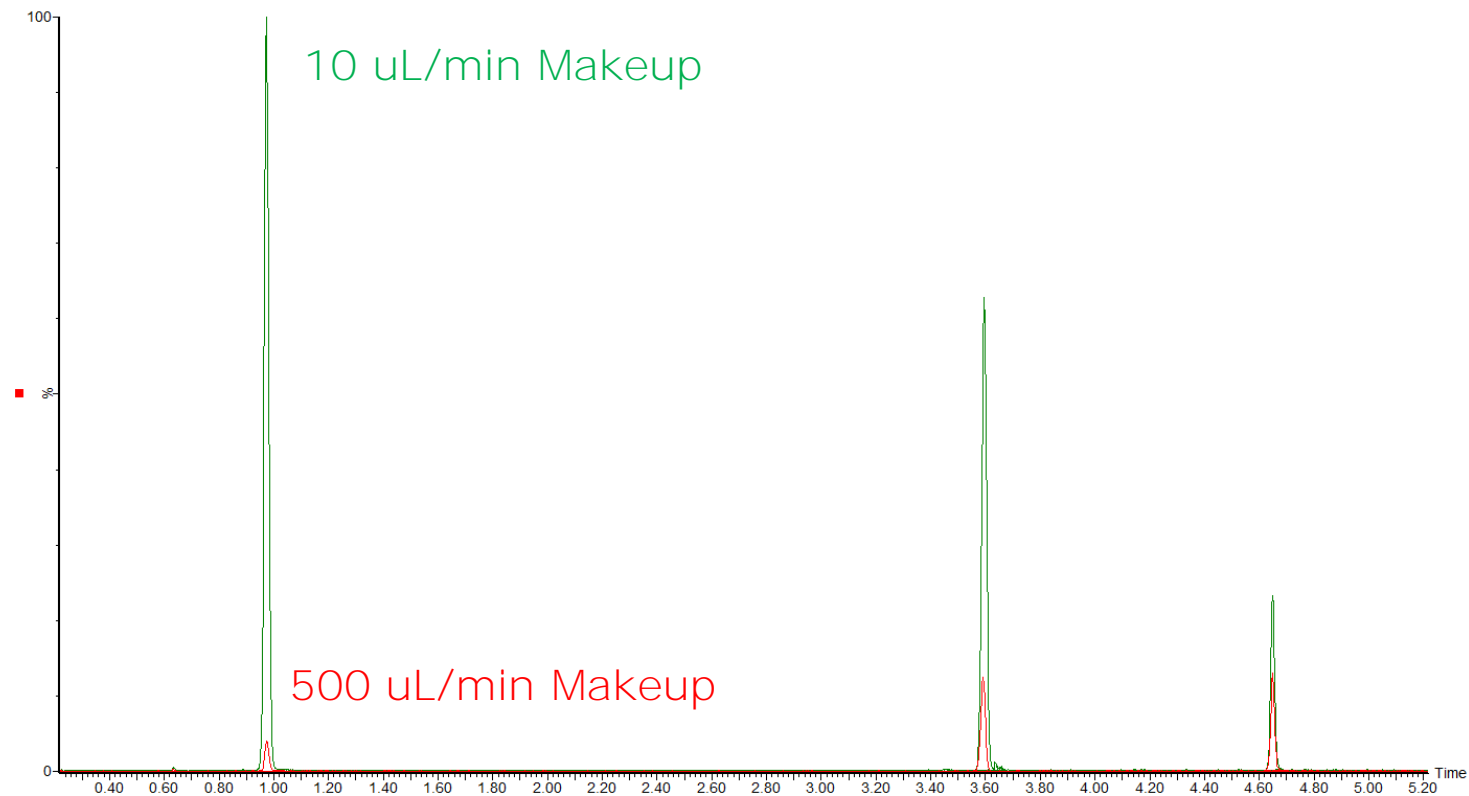
- Restrictor failure can happen
- Easy to replace



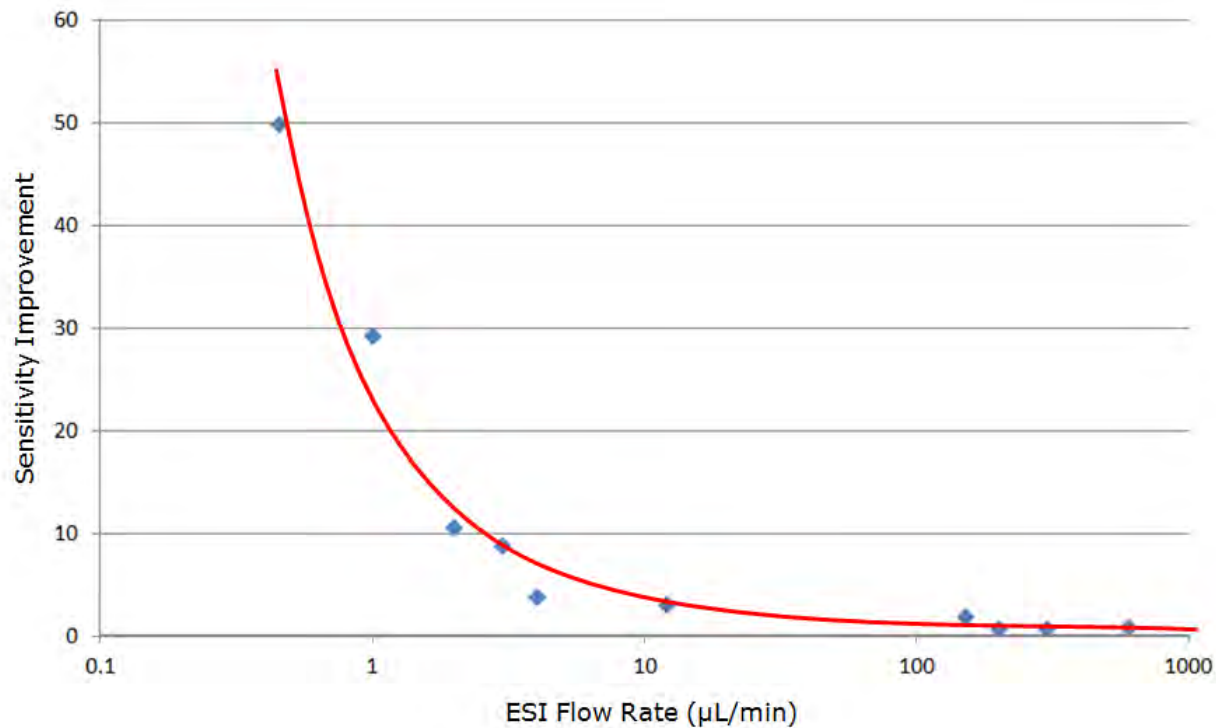
Makeup Flow



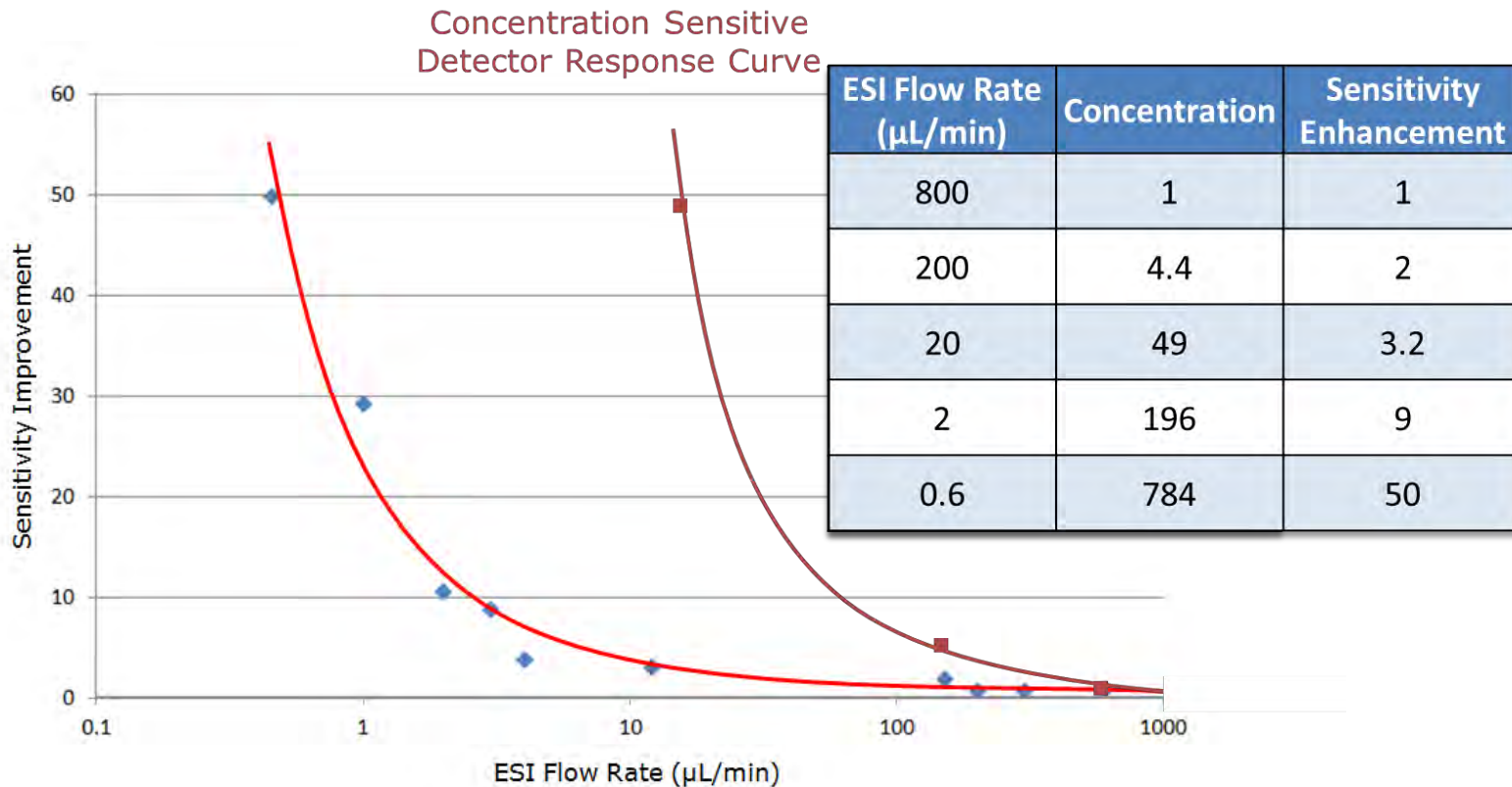
Sensitivity Comparison



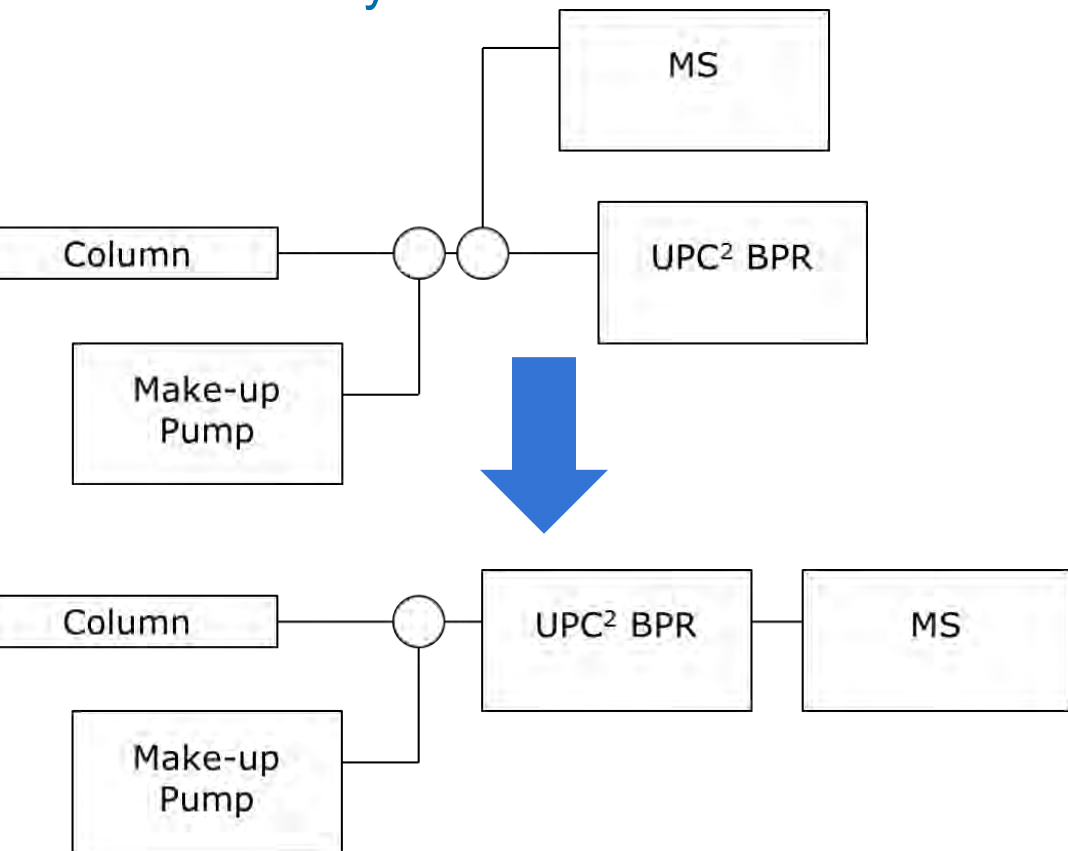
ESI Sensitivity Plot



ESI Sensitivity Plot

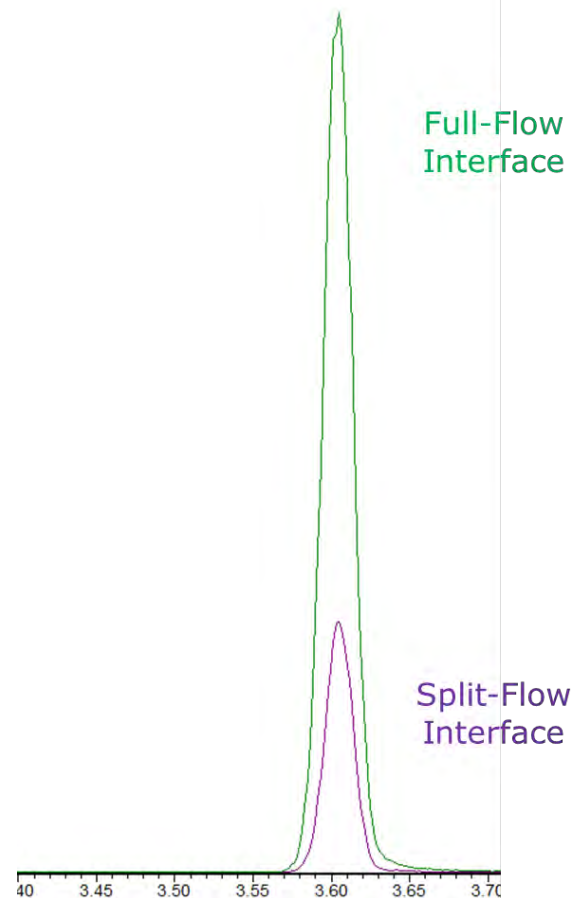


ESI Sensitivity

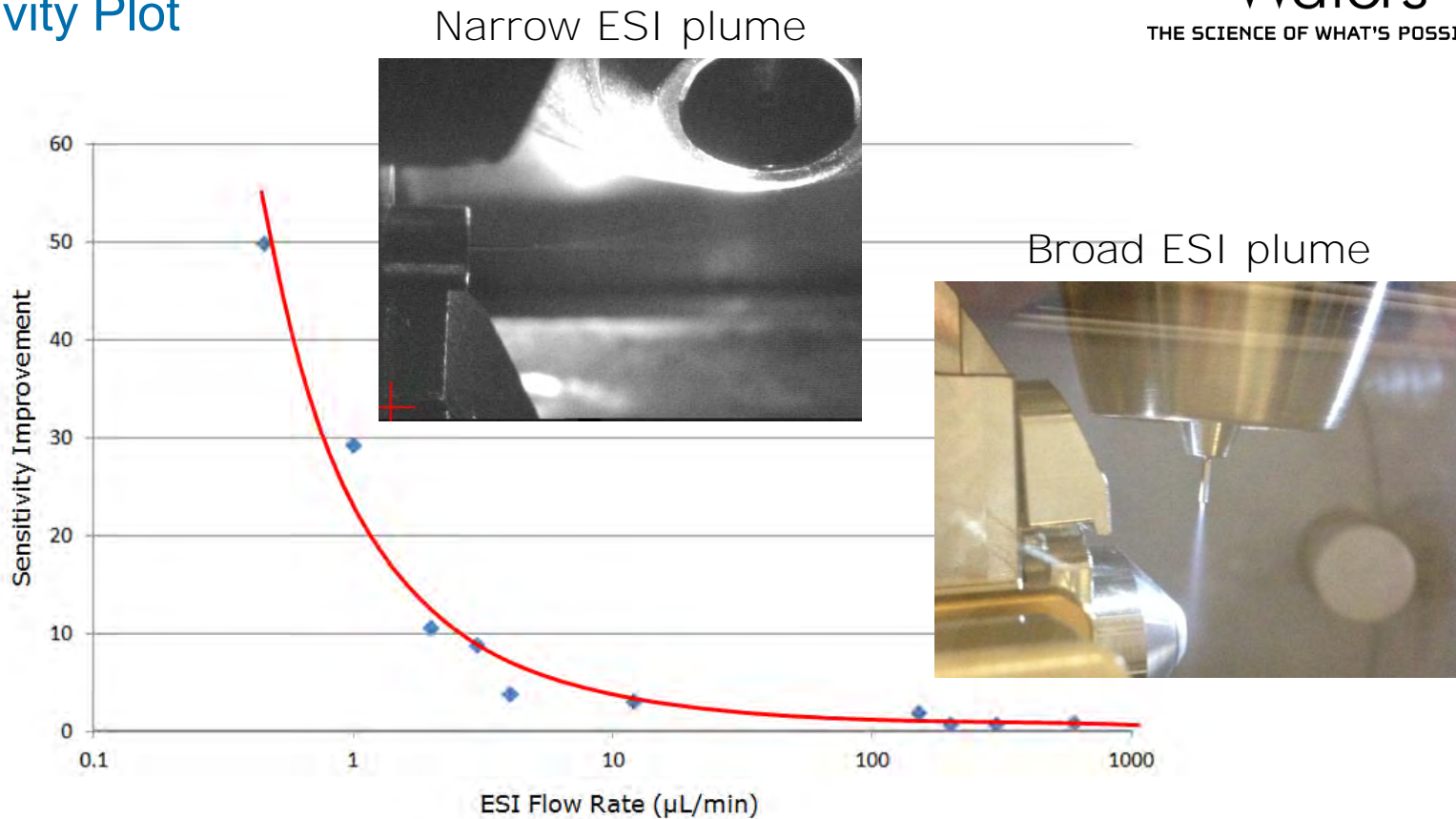


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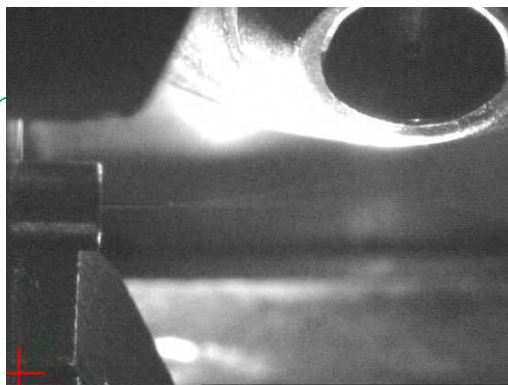


ESI Sensitivity Plot

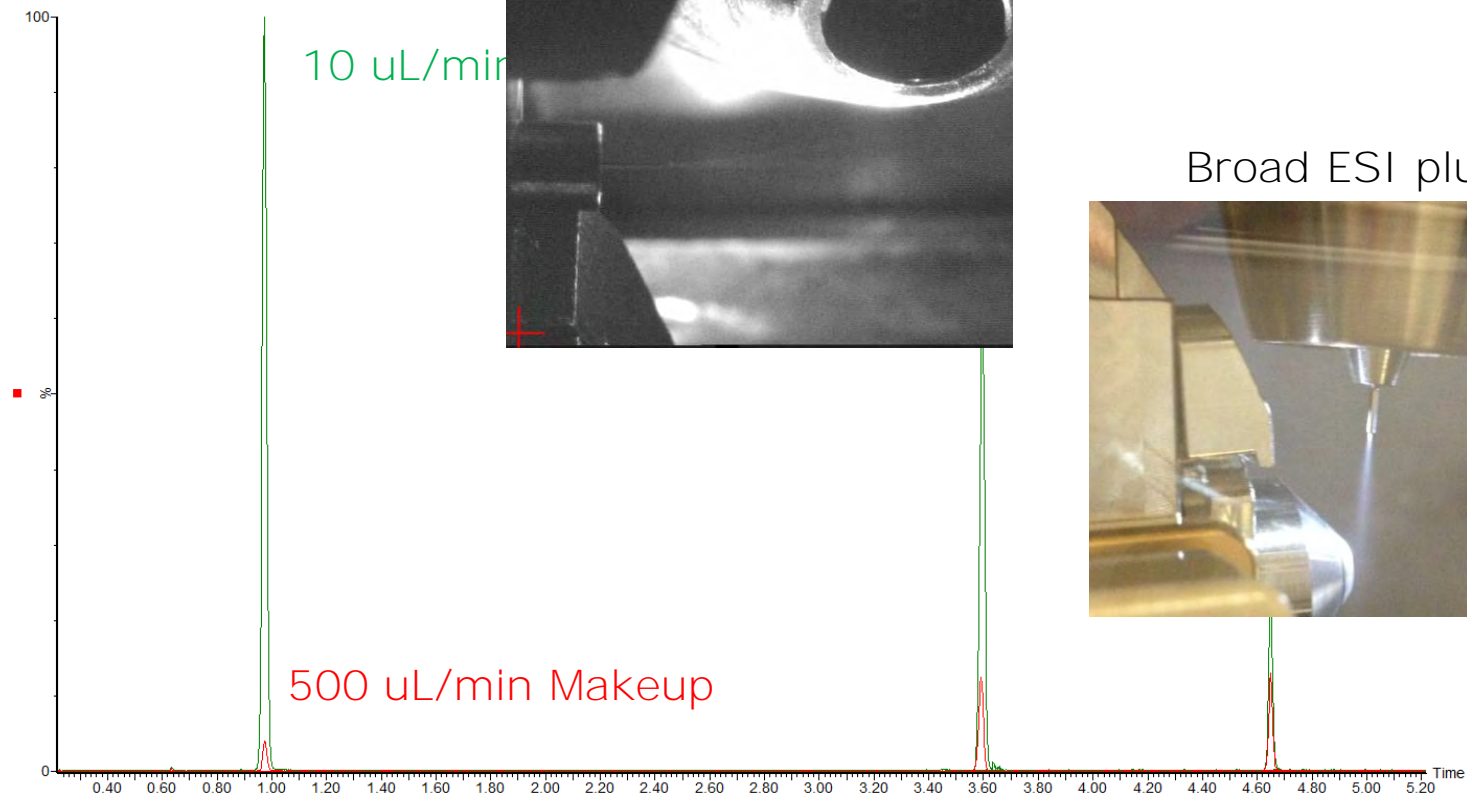
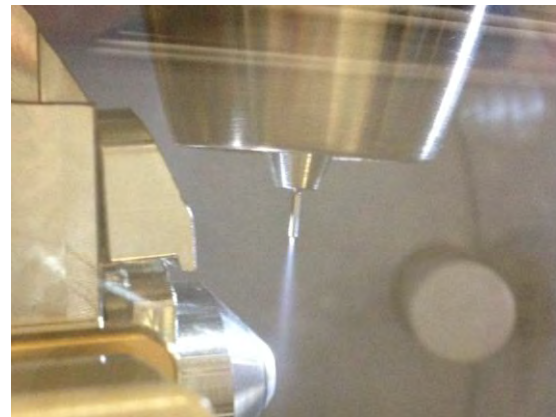


Sensitivity Comparison

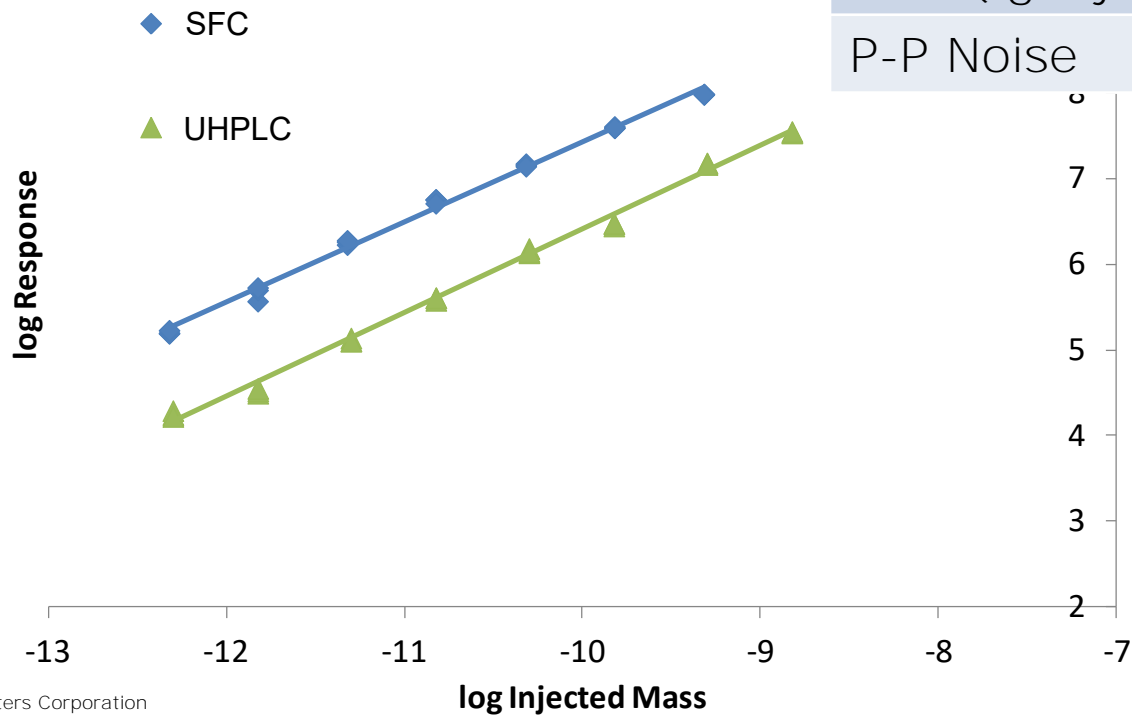
Narrow ESI plume



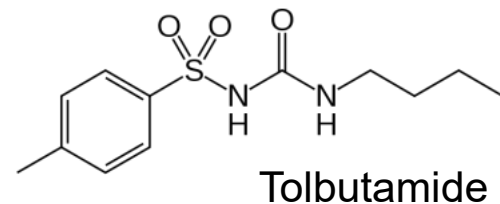
Broad ESI plume



UHPLC-MS vs SFC-MS Sensitivity

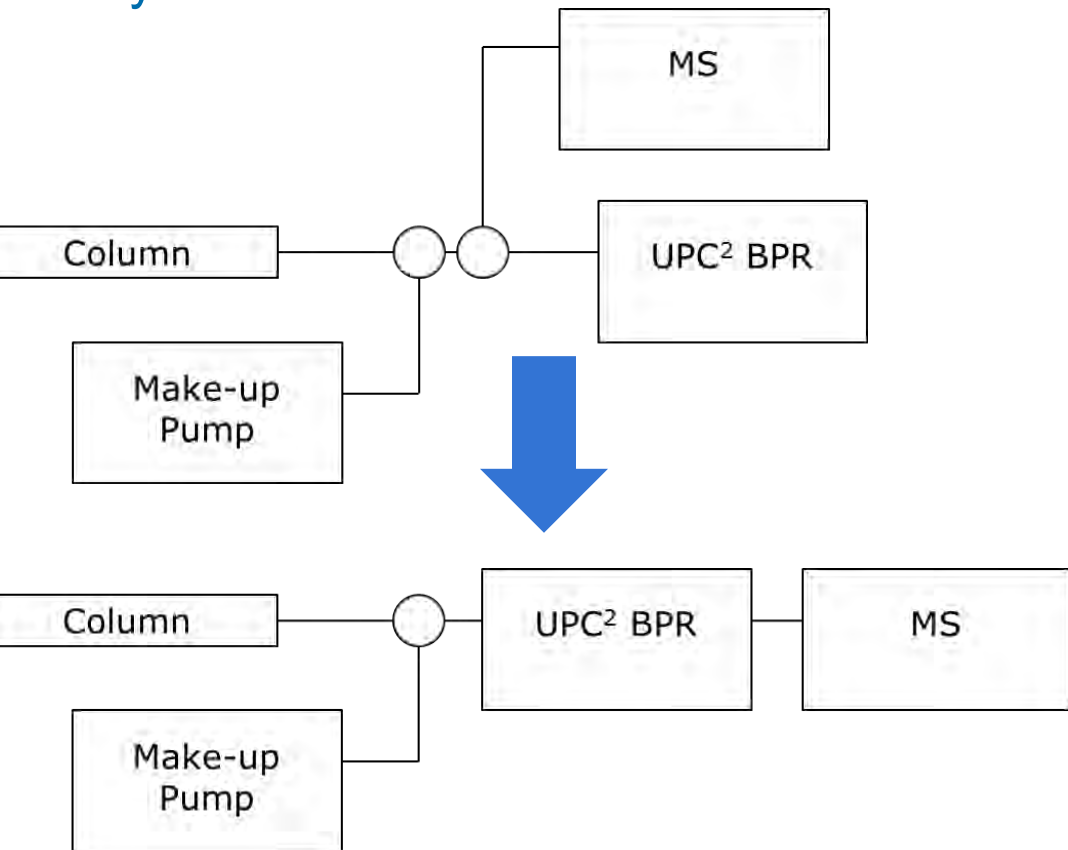


	SFC	UHPLC
LOQ (fg injected) [‡]	54.81	380.1
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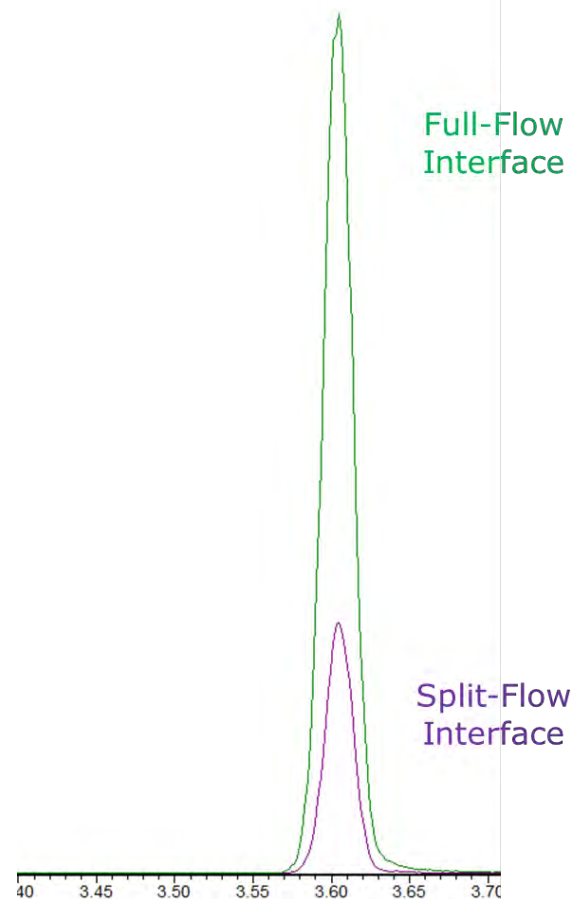
[‡] $S/N_{(p-p)} = 10$

Why No Full-Flow?



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Summary

- **Hardware improvements**
 - Dedicated SFC-MS probe eliminates pulsing
 - Quick-change restrictor
- **Restrictor Robustness**
 - Use appropriate makeup solvent
 - Restrictor is consumable
- **SFC-MS Sensitivity Optimization**
 - Run with low makeup flow
 - SFC-MS sensitivity \geq UPLC-MS sensitivity



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